National Institute of Environmental Health Sciences

GIS-based identification of spatial variables enhancing heat and poor air quality in urban areas

Author(s): Merbitz H, Buttstadt M, Michael S, Dott W, Schneider C
Year: 2012
Journal: Applied Geography. 33 (1): 94-106

Abstract:

Due to anthropogenic climate change heat waves are expected to occur more frequently in the future, which might cause adverse health effects for urban population. Especially the combination of high temperatures and poor air quality impinges on the well-being of man. This accentuates the need for assessing the health risks of residents regarding air pollutants and anomalously high summer air temperatures. However, comprehensive information on the spatial and temporal distribution of temperature and particulate matter (PM) concentration in cities are presently difficult to obtain since only few measurement sites exist. In order to identify hot spots with high health risks for distinct groups of urban population, measurement campaigns were carried out, capturing the spatial distribution of temperature and PM concentrations in the City of Aachen, Germany (pop. 245,000). Several locations were selected to examine spatial influences such as topography, building density, vegetation and traffic on temperature and PM. The findings permit the detection of urban environmental variables that contribute to both temperature enhancement and poor air quality. Those variables were used as spatial predictors for the identification of possible hot spots inside and outside the area of field measurements. The zones of enhanced risks of high air temperature and PM levels were detected by means of GIS based geo-statistic modeling. These areas were mainly identified in the inner city, which is characterized by a dense building structure and heavy traffic. A chemical characterization of different PM fractions complements the GIS based investigations. The analysis of toxicologically relevant components provides information on air quality at urban, suburban and rural sites. The results of the chemical analyses support the results obtained from geo-statistical modeling. It reveals high concentrations of health relevant airborne species like metals and polycyclic aromatic hydrocarbons within the zone of enhanced risk for the coincidence of temperature stress and PM pollution. (C) 2011 Elsevier Ltd. All rights reserved.

Source: http://dx.doi.org/10.1016/j.apgeog.2011.06.008

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

Air Pollution: Particulate Matter

Temperature: Extreme Heat

Geographic Feature: ☑

resource focuses on specific type of geography

Urban

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Germany

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Injury, Respiratory Effect

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Population of Concern: A focus of content

Population of Concern: ☑

populations at particular risk or vulnerability to climate change impacts

Elderly

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content